

# LASER DIODE MODULE

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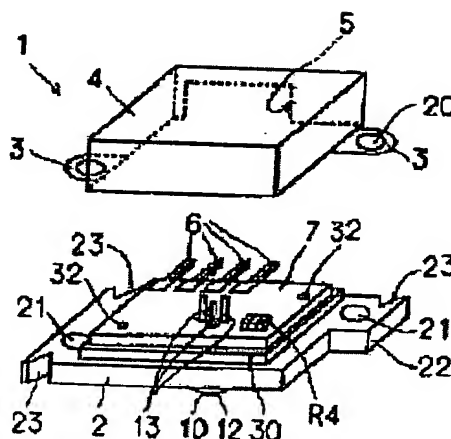
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## Abstract of JP10144988

**PROBLEM TO BE SOLVED:** To reduce the number of parts of a laser diode module and cost.

**SOLUTION:** A module 1 has a module substrate 2 made of a material with improved thermal conductivity, a laser diode 10 that is fixed to the module substrate 2 so that it can be cooled, and a hybrid IC that is fixed to the module substrate 2 and constitutes a circuit for superposing a high frequency to the laser diode 10. Then, a hybrid IC substrate 7 of the above hybrid IC is mounted, so that it overlaps with the module substrate 2. In this case, at least two pins 32 that are deformed by caulking are provided on the module substrate 2 and at the same time a guide according to, for example, a hole into which the pins 32 are inserted is



provided on the hybrid IC substrate 7. The hybrid IC substrate 7 is fixed to the module substrate 7 by the caulking deformation of the pins inserted into the above guide of the hybrid IC substrate.

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a laser diode module, especially the laser diode module which cancels the evil by the reflective return light of a laser diode (LD: semiconductor laser) by high frequency superposition (high frequency bias method).

[0002]

[Description of the Prior Art] Semiconductor laser is widely used as the light source of information processors, such as optical communication, and an optical disk, a laser beam printer.

[0003] The return light of the laser beam by which outgoing radiation was carried out from semiconductor laser leads to generating of a noise, and is not desirable on a system configuration. For example, it is indicated by the Nikkei Business Publications issue "Nikkei electronics" October 10, 1983 issue, and P173-P194 that the reflective return light in semiconductor laser causes degradation of image quality in a video disc.

[0004] Moreover, the semiconductor laser package (laser diode module) which added the high frequency module to this reference as laser for videodisks is indicated. By superimposing a RF, this photoelectron equipment cancels the effect of return light, and is performing stable laser oscillation.

[0005] Moreover, the same LD module also as a Japanese-Patent-Application-No. No. 153217 [ six to ] official report is indicated. If LD module currently indicated by this reference summarizes the configuration, it will be as follows.

[0006] that is, LD module has structure which mounted LD in the whole surface of a tabular heat sink, and mounted the hybrid IC in which was resembled on the other hand and the high frequency bias circuit and the drive circuit were included. LD is TO mold can package structure, fitting immobilization is carried out and the lead terminal is connected to the through hole prepared in said heat sink at said hybrid IC.

[0007] Moreover, a hybrid IC is fixed to a heat sink with covering fixed to said heat sink (module substrate) by the rivet while it serves as the structure of making four pin terminals for external connection projecting from the end of a case.

[0008] Moreover, there is a thing of the structure which carries out a screw stop as a means to fix said hybrid IC substrate to a heat sink.

[0009] On the other hand, the oscillator circuit is indicated by CQ publishing company issue "practical use electronic-circuitry handbook Showa 55 year 11 month 30 day issue, P179 and P180, P184-P186, and P190 - P192 grade. The Colpitts circuit is indicated by this reference as an oscillator circuit.

[0010]

[Problem(s) to be Solved by the Invention] The RF superposition oscillator

circuit for the laser diode module currently used as the light source for magneto-optic-disk memory systems to control the noise at the time of system behavior (noise) is incorporated.

[0011] Moreover, since the hybrid IC substrate of a hybrid IC is fixed to a heat sink (module substrate), it fixes by the rivet or said covering is fixed with the screw. Rivet immobilization and screw fixation took assembly time amount mostly, and have barred reduction of the manufacturing cost of a laser diode module.

[0012] The purpose of this invention is shown in planning cost reduction of a laser diode module by offering the technique which fixes a hybrid IC substrate to a module substrate easily.

[0013] Moreover, the conventional laser diode module has wrap electromagnetic shielding structure in the circuit part with metal covering, the shield sheet which carried out metallizing for control of the spurious radiation oscillated from the oscillator built in.

[0014] For this reason, the number of components of a laser diode module increased, and reduction of the manufacturing cost of a laser diode module is barred.

[0015] Other purposes of this invention are to offer the laser diode module which can aim at reduction of the number of components.

[0016] The other purposes and the new description will become clear from description and the accompanying drawing of this specification along [ said ] this invention.

[0017]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application.

[0018] (1) The module substrate with which thermal conductivity consists of a good ingredient, and the laser diode fixed to said module substrate possible [ heat dissipation ], It has the hybrid IC which constitutes the circuit which is fixed to said module substrate and superimposes high frequency on said laser diode. The hybrid IC substrate of said hybrid IC is a laser diode module which attaches and becomes so that it may lap with said module substrate. While two or more pins transformed into said module substrate with caulking are prepared The guide by the hole with which said pin is inserted in said hybrid IC substrate is prepared, and said hybrid IC substrate is being fixed to said module substrate by caulking deformation of said pin inserted in said guide of said hybrid IC substrate. Said module substrate is formed by cold forging. While the mounting hole is established in said module substrate, it has covering with the electromagnetic shielding function which covers the electronic parts which have in a part the mounting hole which was in agreement with said mounting hole, and were carried in said hybrid IC substrate, and is repeated to said module substrate.

[0019] (2) The module substrate with which thermal conductivity consists of a good ingredient, and the laser diode fixed to said module substrate possible [ heat dissipation ], It is the laser diode module which has the hybrid IC which constitutes the circuit which is fixed to said module substrate and superimposes high frequency on said laser diode. The hybrid IC substrate of said hybrid IC is attached so that each part article mounted in said hybrid IC substrate so that it might lap with said module substrate may meet said module substrate. Grand wiring for electromagnetic shielding is prepared in the whole abbreviation surface in said hybrid IC substrate side which does not meet said module substrate. While two or more pins transformed into said module substrate with caulking are prepared, the guide by the hole with which said pin is inserted in said hybrid IC substrate is prepared, and said hybrid IC substrate is being fixed to said module substrate by caulking deformation of said pin inserted in said guide of said hybrid IC substrate. Said module substrate is formed by cold forging.

[0020] According to the means of the above (1), since it has structure which the hybrid IC substrate of a hybrid IC is inserted in the pin prepared in said module substrate through the guide prepared in the hybrid IC substrate, and is fixed by caulking deformation of said pin, it is not only good, but automation of assembly-operation nature is attained, and reduction of the manufacturing cost of a laser diode module can be aimed at.

[0021] Moreover, slack like screw stop immobilization does not occur, but caulking immobilization has the high dependability of immobilization.

[0022] Moreover, since said module substrate is formed by cold forging, it can aim at reduction of processing cost and can attain reduction of the manufacturing cost of a laser diode module.

[0023] Moreover, since the electronic parts carried in said hybrid IC substrate are covered with covering with an electromagnetic shielding function, since the spurious radiation oscillated from the circuit which superimposes a RF is shielded, it can prevent radio noise interference of the system incorporating a laser diode module.

[0024] According to the means of the above (2), the hybrid IC substrate with which the circuit which superimposes high frequency was incorporated It is attached so that each part article mounted in the hybrid IC substrate may meet a module substrate, Since grand wiring for electromagnetic shielding is prepared in said hybrid IC substrate side which does not meet said module substrate on the whole abbreviation surface, even if it abolishes metal covering like before Since the spurious radiation oscillated from the circuit which superimposes a RF is shielded, it can prevent radio noise interference of the system incorporating a laser diode module. By abolition of said covering, reduction of the number of components of a laser diode module can be aimed at, and reduction of the

manufacturing cost of a laser diode module can be attained.

[0025] Moreover, since it has structure which a hybrid IC substrate is inserted in the pin prepared in said module substrate through the guide prepared in the hybrid IC substrate, and is fixed by caulking deformation of said pin, automation of assembly-operation nature is also attained and it is not only good, but can aim at reduction of the manufacturing cost of a laser diode module.

[0026] Moreover, slack like screw stop immobilization does not occur, but caulking immobilization has the high dependability of immobilization.

[0027] Moreover, since said module substrate is formed by cold forging, it can aim at reduction of processing cost and can attain reduction of the manufacturing cost of a laser diode module.

[0028]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing. In addition, in the complete diagram for explaining the gestalt of implementation of invention, what has the same function attaches the same sign, and explanation of the repeat is omitted.

[0029] (Operation gestalt 1) Drawing 1 thru/or drawing 3 are drawings concerning the laser diode module of the operation gestalt 1 of this invention, and drawing 1 is [ a perspective view and drawing 3 of the decomposition perspective view of a laser diode module and drawing 2 ] top views.

[0030] Moreover, drawing 4 thru/or drawing 7 are drawings concerning manufacture of the laser diode module of this operation gestalt 1. The perspective view drawing 4 indicates the condition of carrying out fitting immobilization of the laser diode to be to a module substrate, The perspective view showing the condition that drawing 5 puts a hybrid IC substrate on a module substrate, Some sectional views showing the condition before caulking immobilization in case drawing 6 fixes a hybrid IC substrate to a module substrate, and drawing 7 are some sectional views showing the condition after the caulking immobilization in the case of fixing a hybrid IC substrate in a module substrate.

[0031] This operation gestalt 1 explains the laser diode module as the light source for magneto-optic-disk memory systems, i. e., the laser diode module incorporating a high frequency superposition circuit. In addition, in structure explanation, it will explain also including the assembly.

[0032] In appearance, as shown in drawing 1 thru/or drawing 3, the laser diode module 1 of this operation gestalt 1 consists of a flat module substrate 2 of an abbreviation rectangle, and covering 4 of the rectangle cube type which puts on the principal plane of said module substrate 2, and has a flange 3 to both ends, and has the structure of making the lead 6 of four which projects in parallel with the principal plane of said module substrate 2 from the opening 5 of said covering 4 projecting.

[0033] The hybrid IC substrate 7 is being fixed to said module substrate 2, and said lead 6 is being fixed to this hybrid IC substrate 7. An inner edge serves as a clamp form, although especially illustration does not carry out the fixed portion, lead 6 clamps so that the connection pad part of the hybrid IC substrate 7 may be put, and it is being fixed to the hybrid IC substrate 7 by the reflow of solder.

[0034] Said module substrate 2 is formed with the aluminum of the thickness whose thermal conductivity is a good ingredient, for example, 2-3mm. Moreover, the ingredient Al050 suitable for cold forging, for example, cold-forging material, is used also in aluminum.

[0035] Moreover, in the rear face (drawing Nakashita side) of said module substrate 2, cap 12 part of the laser diode 10 of a can closure mold has projected.

[0036] The laser diode 10 has the structure of making the lead 13 of three projecting from the rear face ( drawing 4 inferior surface of tongue) of a stem 11 while cap 12 serves as package structure fixed in airtight at the principal plane ( drawing 4 top face) of the stem 11 which consists of a circular metal plate, as shown in drawing 4 . A laser diode chip is arranged in said package, and light is emitted outside from the luminescence aperture 14 of the head-lining part of said cap 12 in the laser beam by which outgoing radiation was carried out from the front outgoing radiation side of a laser diode chip. Moreover, in said package, the photo detector which acts as the monitor of the laser beam by which outgoing radiation is carried out from the back outgoing radiation side of said laser diode chip is arranged.

[0037] In said lead 13 of three, one is a grand (GND) lead, one is the lead which impresses a predetermined electrical potential difference to a laser diode (LD), and one remaining is the lead which takes out the monitor current by the photo detector (PD).

[0038] As shown in drawing 4 , the fitting hole 15 is formed in said module substrate 2, and fitting immobilization of the circular stem 11 of a laser diode 10 is carried out at this fitting hole 15. And the lead 13 of three of a laser diode is electrically connected with predetermined wiring of the hybrid IC substrate 7 by the reflow of solder while penetrating to the connection hole 16 prepared in said hybrid IC substrate 7, as shown in drawing 5 .

[0039] The mounting hole 20 used for the flange 3 of said covering 4 on the other hand in case the laser diode module 1 is fixed to a desired device etc. is formed. Moreover, the mounting hole 21 of the same magnitude is established also in module substrate 2 part which is in agreement with this mounting hole 20.

[0040] Moreover, the end corner of said module substrate 2 used as an abbreviation rectangle is cut and lacked in a rectangle for direction discernment of the laser diode module 1, and the piece 22 of direction

discernment of a short rectangle is formed. Moreover, the notch 23 of the shape of V character used as the positioning criteria at the time of the assembly of the laser diode module 1 is formed in the side-face part of the both ends of said module substrate 2. Although a notch 23 is formed in both sides by the end side of the module substrate 2, it is prepared only in the 1 side by the other end 15, i. e., piece of direction discernment, side.

[0041] Since it has only put on the principal plane of the module substrate 2 as said hybrid IC substrate 7 was covered, said covering 4 can be easily removed, as shown in drawing 1.

[0042] As shown in drawing 1, the hybrid IC substrate 7 is being fixed to the principal plane of the module substrate 2. As the principal plane of said module substrate 2 is shown in drawing 5, the plinth 30 high one step is formed. Said hybrid IC substrate 7 is laid in this plinth 30.

[0043] Moreover, since the lead 6 of a clamp mold is fixed to the hybrid IC substrate 7, a fixed portion projects slightly in the lower part of the hybrid IC substrate 7. Therefore, said plinth 30 is the pattern which escapes and has 31 so that the amount of this lobe may contact the module substrate 2 directly and it may not cause short-circuit electrically.

[0044] Moreover, although this is one of the descriptions of this invention, the pin (projection) 32 transformed into two places with caulking is formed in the plinth 30 of said module substrate 2. This pin 32 is long slightly rather than the thickness of said hybrid IC substrate 7.

[0045] On the other hand, as shown in drawing 5, the guide 33 which consists of a hole corresponding to said pin 32 is formed in said hybrid IC substrate 7, so that said pin 32 can be inserted.

[0046] Said module substrate 2 is formed with aluminum, and forms the ingredient Al050 suitable for cold forging, for example, cold-forging material, with cold forging. The thickness of plinth 30 part of the module substrate 2 is about 3mm, and the die length of a pin 32 is about 1.1mm for the diameter of 1.4mm.

[0047] Said hybrid IC substrate 7 is a GARAPO substrate about 16mm and whose thickness about 10mm and die length are about 0.8mm for width of face. moreover, the hole which constitutes the guide 33 dug by the hybrid IC substrate 7 is about 1.4mm in diameter, and can insert said pin 32 -- it is inserting each other in.

[0048] When attaching said hybrid IC substrate 7 in the module substrate 2, as the pin 32 of the module substrate 2 is made to insert in the guide 33 of said hybrid IC substrate 7, both are laid on top of it. On the table 34 of caulking equipment, it is positioned and the module substrate 2 and the hybrid IC substrate 7 which were piled up mutually are laid, as shown in drawing 6.

[0049] Then, it is caulking \*\*, as the caulking fixture 35 located above



said table 34 is dropped, the pin 32 projected on the top face of said hybrid IC substrate 7 is pressed to the punch 36 to which the tip prepared so that said pin 32 might be met consists of a configuration projected in the shape of a cone and it is shown in drawing 7 .

[0050] Since the tip of punch 36 is the configuration projected in the shape of a cone, the amount of [ of the pin 32 which projects from a guide 33 ] point deforms so that it may push on radial and may spread from a core, and in order to cover the periphery of the guide 33 with which this caulking variant part 37 consists of a hole of the hybrid IC substrate 7, the hybrid IC substrate 7 will certainly be fixed to the module substrate 2. This caulking immobilization has the high dependability of immobilization, without loosening like screw fixation by vibration etc. after that.

[0051] Said hybrid IC substrate 7 consists of a wiring substrate, for example, it becomes a GARAEP0 substrate by the glass epoxy resin, and as shown in drawing 9 , wiring 25 is formed in the principal plane ( drawing 1 top face). In addition, wiring and loading electronic parts are omitted except drawing 9 .

[0052] This wiring 25 has connection pad 25b for attaching land 25a for carrying each electronic parts, and said lead 6, connection 25c which aims at connection with the lead 13 of said laser diode 10, as shown in drawing 9 . In addition, 25d is a through hole.

[0053] The equal circuit of the laser diode module of this operation gestalt 1 is circuitry which adds RF superposition to a laser diode LD, as shown in drawing 8 . That is, as an oscillator circuit which adds high frequency superposition, the Colpitts circuit of a transistor (Q1) stone is incorporated.

[0054] A Colpitts circuit has a collector and structure which incorporates Coil L between the bases while incorporating capacity C between the collector of a transistor, and an emitter, and between an emitter and the base, respectively.

[0055] So, as shown in drawing 8 , while incorporating C2 between the collector C of a transistor (Q1), and Emitter E, capacity C1 is incorporated between Emitter E and Base B, and a coil L1 is incorporated between Collector C and Base B, and the Colpitts circuit consists of laser diode modules 1 of this operation gestalt 1.

[0056] Moreover, the external terminals are four terminals of Vcc, LD, PD, and GND. For a capacitor, and R1-R3, resistance, and L1 and L2 are [ C1-C8 / a laser diode and PD of an inductor and LD ] photo detectors.

[0057] The loading condition of electronic parts is shown in drawing 9 . Electronic parts, such as each capacitor, resistance, and an inductor, are fixed by the reflow of the solder beforehand put on land 25a. Moreover, the reflow of the solder which the lead 13 of a laser diode 10 was inserted in the connection hole 16 prepared in the hybrid IC substrate 7, and was

beforehand put on connection 25c is fixed. Moreover, the lead 6 of clamp structure is attached in a connection pad 25b part by the clamp, and the reflow of the solder beforehand put on said connection pad 25b is fixed. [0058] In the circuit shown in drawing 8, if moderate DC electrical potential difference (Vcc) is applied between 2 terminals (Vcc, GND), irregular vibration of the current by the turbulence and heat of a power up will be used as a seed, and the component chosen as the resonance circuit formed with the capacity C and Coil L of these will be amplified, and positive feedback is repeated, and an oscillation will be started and it will continue. Consequently, a laser diode (LD) is overlapped on high frequency, the oscillation of a laser beam by which outgoing radiation is carried out from a laser diode chip serves as a multimode, and it is hard coming to generate the turbulence of the oscillation by the return light of a laser beam.

[0059] In the assembly, the laser diode module 1 of this operation gestalt 1 carries out fitting immobilization of the laser diode 10 at the fitting hole 15 of the module substrate 2, as shown in drawing 4. Then, after putting the hybrid IC substrate 7 with which electronic parts were carried and the lead 6 was attached on the principal plane of the module substrate 2, as it is shown in drawing 6 and drawing 7, the hybrid IC substrate 7 is fixed to the module substrate 2 by carrying out caulking deformation of the tip of the pin 32 inserted in the guide 33 of the hybrid IC substrate 7 by caulking equipment.

[0060] Subsequently, the lead 13 of the laser diode 10 inserted in the connection hole 16 of the hybrid IC substrate 7 is fixed by the solder reflow. Furthermore, as shown in drawing 1, it becomes the product gestalt which can be shipped by changing into the condition of drawing 2 in piles so that the hybrid IC substrate 7 may be covered to the principal plane side of said module substrate 2.

[0061] The laser diode module 1 of this operation gestalt 1 does the following effectiveness so.

[0062] (1) Loosen like screw fixation after that, a phenomenon stops occurring from having structure which the hybrid IC substrate 7 of a hybrid IC is inserted in the pin 32 prepared in the module substrate 2 through the guide 33 prepared in the hybrid IC substrate 7, and is fixed by caulking deformation of said pin 32, and the dependability of immobilization becomes high.

[0063] (2) Since the hybrid IC substrate 7 fixes the laser diode module 1 of this operation gestalt 1 to the module substrate 2 with caulking by the above (1), assembly is easy and assembly-operation nature is high.

[0064] (3) By the above (1), since the hybrid IC substrate 7 has structure fixed to the module substrate 2 with caulking, the automation of immobilization of the module substrate 2 and the hybrid IC substrate 7 of the laser diode module 1 of this operation gestalt 1 is also attained.

[0065] (4) By the above (1), manufacture of the pin for caulking immobilization can be formed in coincidence, when manufacturing a module substrate with cold forging, and since the hole of the hybrid IC substrate containing said pin can be formed in coincidence at the time of the through hole manufacture in hybrid IC substrate manufacture, processing cost is reduced.

[0066] (5) Since the module substrate 2 which is the component part is manufactured by cold forging, its manufacturing cost is [ the laser diode module 1 of this operation gestalt 1 ] cheap. Moreover, since the pin 32 of the module substrate 2 can also be manufactured with cold forging, it becomes reduction of the cost concerning the fixed means of the module substrate 2 and the hybrid IC substrate 7.

[0067] (6) Since the electronic parts carried in the hybrid IC substrate 7 are covered with covering with an electromagnetic shielding function, and the spurious radiation oscillated from the circuit which superimposes a RF is shielded, the laser diode module 1 of this operation gestalt 1 can prevent radio noise interference of the system incorporating the laser diode module 1.

[0068] (7) The above (1) By - (6), the laser diode module 1 of this operation gestalt 1 can aim at reduction of a manufacturing cost from the cost reduction by reduction of the number of components for immobilization, reduction of the processing cost of the module substrate 2, automation of fixed cost, etc.

[0069] (Operation gestalt 2) Drawing 10 and drawing 11 are drawings concerning the laser diode module which is the operation gestalt 2 of this invention, and it is the typical sectional view in which drawing 10 shows the perspective view of a laser diode module, and drawing 12 shows a module substrate and a hybrid IC substrate.

[0070] This operation gestalt 2 is structure which does not need said covering in the laser diode module 1 of the structure of said operation gestalt 1.

[0071] That is, as shown in drawing 10, the hybrid IC substrate 7 of said operation gestalt 1 is turned over, and it fixes to the module substrate 2. And unless it considers as a pattern which does not lead to other wiring, it covers the largest possible area, namely, trouble is caused to the rear face of the hybrid IC substrate 7, it has structure which formed the grand wiring 40 in the whole surface.

[0072] By this, even if it does not prepare metal covering, the grand wiring 40 of the rear face of the hybrid IC substrate 7 will act as an electromagnetic shielding object.

[0073] Since the field in which the circuit pattern of the hybrid IC substrate 7 in the laser diode module 1 of this operation gestalt 2 carries each electronic parts meets the principal plane of the module substrate 2, modification is made according to it.

[0074] Moreover, since the principal plane of the module substrate 2 is contacted, or the electronic-parts group 41 carried in the hybrid IC substrate 7 approaches and it is made not to produce short-circuit as shown in drawing 11 , by making into a stepped pin the pin 32 prepared in the principal plane of the module substrate 2, it floats and the hybrid IC substrate 7 can be supported.

[0075] In addition to the effectiveness that the laser diode module 1 of said operation gestalt 1 does so, the laser diode module 1 of this operation gestalt 2 does the following effectiveness so.

[0076] (1) Since the laser diode module 1 of this operation gestalt 2 is attached so that each part article with which the hybrid IC substrate 7 with which the circuit which superimposes high frequency was incorporated was mounted in the hybrid IC substrate 7 may meet the module substrate 2, the hybrid IC substrate 7 can be used for it as covering of a package, and it can aim at reduction of the number of components.

[0077] (2) Since the grand wiring 40 is formed in the rear face of the hybrid IC substrate 7 used as covering all over abbreviation , in order that this grand wiring 40 may act as an electromagnetic shielding object , radio noise interference of the system which it stops having made the spurious radiation oscillated from a RF superposition circuit emit outside , and incorporated the laser diode module 1 can be prevented .

[0078] Although invention made by this invention person above was concretely explained based on the operation gestalt That it can change variously in the range which this invention is not limited to the above-mentioned operation gestalt, and does not deviate from the summary [ needless to say ] for example, a hole like said operation gestalt as what guides the pin 32 prepared in the principal plane of the module substrate 2 -- a guide like the V character slot established in except on the side face of the hybrid IC substrate 7 may be used. That is, if said pin 32 is guided, there is a part which receives caulking deformation and the hybrid IC substrate 7 can be fixed to the module substrate 2, what kind of configuration and structure are sufficient.

[0079] Moreover, as covering of electromagnetic shielding structure, covering made of resin which scoured silver dust etc. to resin besides metal covering may be used. Moreover, as an electromagnetic shielding object of the rear face of the hybrid IC substrate 7, the attachment structure of a foil etc. is sufficient.

[0080] Although the above explanation explained the case where it applied to the laser diode module which uses invention mainly made by this invention person for the light source for magneto-optic-disk memory systems used as the background which is a field of the invention, it is not limited to it. This invention is applicable to the technique of making high frequency superimposing on a laser diode at least, and attaining multimode-ization of a laser beam.

[0081]

[Effect of the Invention] It will be as follows if the effectiveness acquired by the typical thing among invention indicated in this application is explained briefly.

[0082] (1) Since a hybrid IC substrate is fixed to a module substrate with caulking, the dependability of immobilization becomes high.

[0083] (2) Caulking immobilization can attain reduction of the cost for immobilization that it is easy to attain automation while it is easy to work.

[0084] (3) Manufacture of the pin for caulking immobilization can be formed in coincidence when manufacturing a module substrate with cold forging, and since the hole of the hybrid IC substrate containing said pin can be formed in coincidence at the time of the through hole manufacture in hybrid IC substrate manufacture, processing cost is reduced.

[0085] (4) While turning a hybrid IC substrate over and fixing to a module substrate, with the structure of preparing grand wiring in the rear face (outside field) of a hybrid IC substrate all over abbreviation, it is an electromagnetic shielding object, covering which plays the role from which the electronic parts carried are protected becomes unnecessary, and reduction of the number of components can attain reduction of the cost of a laser diode module.

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[Translation done.]

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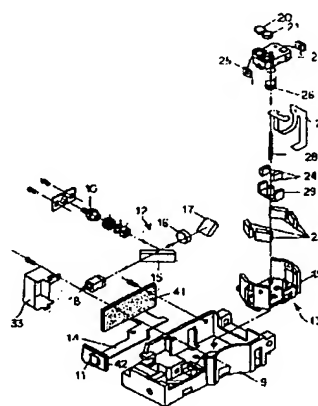
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权利要求书 3 页 说明书 7 页 附图页数 6 页

[54] 发明名称 具有高频重叠电路的光检取装置

[57] 摘要

在采用高频重叠法的光检取装置中,在 FPC 上搭载高频重叠电路。这样,减少印刷电路板的安装工序,提高组装的作业性。另外,通过将导通电镀面和增强板的导通电镀面进行电连接,所述导通电镀面是在 FPC 的凸出部上形成的 GND 模样导通的导通电镀面,能够以短距离连接 GND 模样和宽广的 GND,提高抑制无用辐射的效果。



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## 权 利 要 求 书

1. 一种光检取装置，包括向光盘投射光的光源、接收来自光盘的反射光将所接收的光信号变换为电信号的接收光装置、通过高频重叠法驱动  
5 所述光源的高频重叠电路、具有为驱动这些光源以及高频重叠电路的信号和来自所述接收光装置的信号的输入输出电路以及连接头的可挠性印刷布线基板（称为 FPC），

其特征是所述高频重叠电路搭载在所述 FPC 上。

2. 根据权利要求 1 所述的光检取装置，其特征是还包括在背面形成  
10 有导电电镀面的增强板，

在所述 FPC 上，形成有接地（称为 GND）模样、从该 FPC 的外形延长凸出的凸出部、该凸出部表面上和该 GND 模样导通的导电电镀面，

在所述增强板的表面上粘贴所述 FPC 的背面，将该 FPC 的凸出部弯折，让该导电电镀面电连接在所述增强板的导电电镀面上。

15 3. 根据权利要求 1 所述的光检取装置，其特征是还包括在背面形成有导电电镀面的增强板，

在所述 FPC 上，形成有接地（称为 GND）模样，

在所述增强板的表面上粘贴所述 FPC 的背面同时电连接，

在所述增强板的导电电镀面上粘贴铜箔片，将该片的局部凸出部弯  
20 折，电连接在所述 FPC 的 GND 模样上。

4. 根据权利要求 1 所述的光检取装置，其特征是所述 FPC 为 2 层结构，在第 1 层上形成部件搭载的布线电路以及 GND 模样，而在第 2 层上形成铜箔面。

5. 根据权利要求 1 所述的光检取装置，其特征是所述光检取装置具  
25 有导电金属制成的基座，所述高频重叠电路由固定在所述基座上的 HF 屏



蔽盖所覆盖。

6. 根据权利要求 2 所述的光检取装置，其特征是所述 FPC 在介于所述增强板的状态下固定在所述基座的外侧面上。

7. 根据权利要求 3 所述的光检取装置，其特征是所述 FPC 在介于所述增强板的状态下固定在所述基座的外侧面上。

8. 一种光检取装置，包括向光盘投射光的光源、接收来自光盘的反射光将所接收的光信号变换为电信号的接收光装置、通过高频重叠法驱动所述光源的高频重叠电路、具有为驱动这些光源以及高频重叠电路的信号和来自所述接收光装置的信号的输入输出电路以及连接头的可挠性印刷  
10 布线基板（称为 FPC），

其特征是所述光检取装置具有导电金属制成的基座，在该基座上保持所述光源、接收光装置以及 FPC，在所述 FPC 上搭载所述高频重叠电路。

9. 根据权利要求 8 所述的光检取装置，其特征是还包括在背面形成了导电电镀面的增强板，

15 在所述 FPC 上，形成有接地（称为 GND）模样、从该 FPC 的外形延长凸出的凸出部、该凸出部表面上和该 GND 模样导通的导电电镀面，

在所述增强板的表面上粘贴所述 FPC 的背面，将该 FPC 的凸出部弯折，让该导电电镀面电连接在所述增强板的导电电镀面上。

10. 根据权利要求 8 所述的光检取装置，其特征是还包括在背面形成  
20 有导电电镀面的增强板，

在所述 FPC 上，形成有接地（称为 GND）模样，

在所述增强板的表面上粘贴所述 FPC 的背面同时电连接，

在所述增强板的导电电镀面上粘贴铜箔片，将该片的局部凸出部弯折，电连接在所述 FPC 的 GND 模样上。

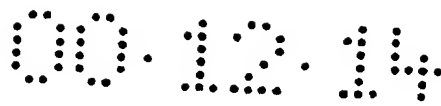
25 11. 根据权利要求 8 所述的光检取装置，其特征是所述 FPC 为 2 层结

构，在第 1 层上形成部件搭载的布线电路以及 GND 模样，而在第 2 层上形成铜箔面。

12. 根据权利要求 8 所述的光检取装置，其特征是所述光检取装置具有导电金属制成的基座，所述高频重叠电路由固定在所述基座上的 HF 屏蔽盖所覆盖。

13. 根据权利要求 9 所述的光检取装置，其特征是所述 FPC 在介于所述增强板的状态下固定在所述基座的外侧面上。

14. 根据权利要求 10 所述的光检取装置，其特征是所述 FPC 在介于所述增强板的状态下固定在所述基座的外侧面上。



## 说明书

98/15

### 具有高频重叠电路的光检取装置

5 本发明涉及一种针对 CD(压缩光盘: Compact Disc)、DVD(数字化视频光盘: Digital Video Disc)、MD(小型光盘: Mini Disc)等各种记录介质在光学上进行信息的记录以及/或者播放的光检取装置, 特别涉及一种具有高频驱动激光二极管等光源的高频重叠电路的装置。

以往, 在光检取装置中, 采用半导体激光器(以下称为激光二极管)  
10 发出的激光进行记录播放时, 从光盘反射的光会返回到激光二极管, 该返回光会扰乱激光二极管的模式, 会在信号中产生噪声。为了防止该噪声的产生, 周知有采用给激光二极管供给高频电流进行驱动的高频重叠法。在采用该方法的装置中, 虽然具备有高频重叠电路, 但该高频重叠电路的振荡频率成分向外部的泄漏则成为无用辐射。

15 在此, 作为防止该无用辐射的对策, 周知有将激光二极管和高频重叠电路放入屏蔽盒内、该电路的 GND(接地)模样直接与屏蔽盒等电连接的装置, 或者在与该电路连接的线从屏蔽盒向外部引出的构成中、从屏蔽盒引出线的引出口附近、在该线和 GND 之间连接电容的装置(例如, 可参照特开平 11-144283 号、特开平 6-268385 号、特开平 9-63088 号公报)。

20 然而, 在采用如上所述的现有高频重叠电路法的光检取装置中, 连接光检波器和驱动器一侧的控制电路的电缆连接用的连接头以及周边电路被设置的 FPC(可挠性印刷布线基板)和高频重叠电路的印刷电路板采用另外的基板, 将高频重叠电路构成在小的印刷电路板上。为此, 成为作业工序多, 组装作业性差的装置, 增加了成本。另外, 为了防止无用辐射,  
25 需要扩大高频重叠电路的 GND, 以尽量短的布线距离进行连接来获得稳定

的 GND，但在目前，该距离较长，充分抑制辐射较为困难。

5 本发明的目的在于提供一种具有高频重叠电路的光检取装置，其在采用了高频重叠法的光检取装置中，不是将高频重叠电路设置在与设置了连接头的 FPC 另外的印刷电路板上，而是通过搭载在 FPC 上，减少了作业工  
序，提高了组装的作业性，降低了成本，以便克服上述缺陷。本发明的另一目的在于提供一种可以扩大高频重叠电路的 GND，以短的布线距离与稳定的 GND 连接，获得充分防止无用辐射效果的光检取装置。

10 本发明的上述目的是这样实现的：一种光检取装置，包括向光盘投射光的光源、接收来自光盘的反射光将所接收的光信号变换为电信号的接收光装置、通过高频重叠法驱动所述光源的高频重叠电路、具有为驱动这些光源以及高频重叠电路的信号和来自所述接收光装置的信号的输入输出电路以及连接头的可挠性印刷布线基板（称为 FPC），其特征是所述高频重叠电路搭载在所述 FPC 上，或者所述光检取装置具有导电金属制成的基座，在该基座上保持所述光源、接收光装置以及 FPC，在所述 FPC 上搭载  
15 所述高频重叠电路。

20 本发明所述的光检取装置，其特征是还包括在背面形成有导电电镀面的增强板，在所述 FPC 上，形成有接地（称为 GND）模样、从该 FPC 的外形延长凸出的凸出部、该凸出部表面上和该 GND 模样导通的导电电镀面，在所述增强板的表面上粘贴所述 FPC 的背面，将该 FPC 的凸出部弯折，让该导电电镀面电连接在所述增强板的导电电镀面上。

本发明所述的光检取装置，其特征是还包括在背面形成有导电电镀面的增强板，在所述 FPC 上，形成有接地（称为 GND）模样，在所述增强板的表面上粘贴所述 FPC 的背面同时电连接，在所述增强板的导电电镀面上粘贴铜箔片，将该片的局部凸出部弯折，电连接在所述 FPC 的 GND 模样上。

25 本发明所述的光检取装置，其特征是所述 FPC 为 2 层结构，在第 1

层上形成部件搭载的布线电路以及 GND 模样，而在第 2 层上形成铜箔面。

本发明所述的光检取装置，其特征是所述光检取装置具有导电金属制成的基座，所述高频重叠电路由固定在所述基座上的 HF 屏蔽盖所覆盖。

本发明所述的光检取装置，其特征是所述 FPC 在介于所述增强板的状态下固定  
5 在所述基座的外侧面上。

下面结合实施例所示附图，对本发明作进一步详细说明。本实施方案的光检取装置是适用于针对光盘的 CD 以及 DVD 在光学上进行信息记录以及/或者播放的驱动器的装置。

图 1 为表示依据本发明一实施方案的光检取装置所适用的驱动器的  
10 机座底壳部分的斜视图；

图 2 为表示上述光检取装置的分解斜视图；

图 3 为表示用于上述光检取装置中 FPC 的斜视图；

图 4(a)、图 4(b)和图 4(c)分别表示上述 FPC 组装过程中的构成的正面图、侧截面图、背面图；

15 图 5(a)、图 5(b)和图 5(c)分别表示上述 FPC 组装后的构成的正面图、侧截面图、背面图；

图 6(a)、图 6(b)和图 6(c)分别表示依据另一实施方案的 FPC 组装过程中的构成的正面图、侧截面图、背面图；

图 7(a)、图 7(b)和图 7(c)分别表示依据另一实施方案的 FPC 组装后  
20 的构成的正面图、侧截面图、背面图；

图 8 为表示图 5(b)的局部放大图。

参照图 1，其表示驱动器的机座底壳部分。在机座底壳 1 中设置有为转动驱动光盘的转盘 2、进行光盘信息读取的光检取装置 3。光检取装置 3 被导引轴 5、6 所支撑，所述导引轴 5、6 由马达 4 驱动并可滑动移动，  
25 具有对应于 CD 和 DVD 的切换使用的镜片 7、8。

参照图 2，其表示光检取装置 3 的分解图。光检取装置 3 具有导电金属制成的基座 9，在基座 9 上搭载激光二极管（光源）10、构成投射激光，将来自光盘的反射光导向光电二极管（接收装置）11 的光学系的光学元件 12、进行镜片切换的镜片底座 13、以及构成激光二极管 10 以及光电二极管 11 的外围电路的 FPC（可挠性印刷电路基板）14。光电二极管 11 将所接收的光信号变换成电信号。光学元件 12 由半反射镜 15、瞄准镜 16、反射镜 17 以及传感器镜片 18 等构成。镜片底座 13 由基底 19、为支撑及切换 DVD 镜片 20 和 CD 镜片 21 的可转动的镜片支架 22、跟踪用磁铁 23、聚焦用磁铁 24、跟踪用线圈 25、聚焦用线圈 26、FPC27、以及支撑轴 28、轴底座 29 等构成。另外，以高频重叠法驱动激光二极管 10 的高频重叠电路 35（后述的图 3），不使用另外的印刷电路基板，而是搭载在 FPC14 上。让 HF 屏蔽盖 33 象覆盖该高频重叠电路 35 那样固定在基座 9 上，以便防止无用的辐射。

在上述光检取装置 3 中，从激光二极管 10 射出的激光通过半发射镜 15 反射，经过瞄准镜 16 以及反射镜 17 由镜片 20 或者 21 投射到光盘上，来自光盘的反射光经过反射镜 17 以及瞄准镜 16 透过半反射镜 15，由传感器镜片 18 导向光电二极管 11。这样，可以进行光盘的信息读出。

接着，结合图 3 说明 FPC14 的构成。在 FPC14 上，设置有激光二极管 10、高频重叠电路 35（图中省略了搭载部件）、以及为驱动镜片的信号和来自光电二极管 11 的输入输出信号用的外围电路 36，并且，形成有为搭载与驱动器一侧的控制电路（图中未画出）电缆连接的连接头 37 的连接头端子 38。该连接头端子 38 和连接光电二极管 11 等各种部件的端子，通过导电电镀形成。在该端子上由焊锡焊接有连接头 37 和各种部件。在外围电路 36 中，也包含 GND（接地）模样 36a。另外，在 FPC14 的某部位粘贴有在其背面形成了导电电镀面 46 的树脂制成的增强板 41 和铝制

成的增强板 42。FPC14 横跨基座 9 的底面和两个侧面，在侧面介入有增强板 41、42 的状态下，可通过粘接、螺钉加以固定。此外，在高频重叠电路 35 中设置有激光二极管 10 的引线连接用端子和孔 43。

依据这样的本实施方案，由于高频重叠电路 35 是搭载在 FPC14 上而不是采用与该 FPC 另外的印刷电路板，因此可以减少印刷电路板安装的工序，有利于组装的作业性。

接着，参照图 4 以及图 5 说明防止无用辐射的 FPC14 的构成。在 FPC14 上，形成有具有 GND 模样 36a 的延长部向该 FPC14 的外形局部凸出的凸出部 14a，该凸出部 14a 表面为罩环状（カバーレイ）开口，形成与 GND 模样 36a 导通的导电电镀面 45。另外，在粘贴在 FPC14 的局部位置的增强板 41 上，与该粘贴面相反的面（背面）上形成有导电电镀面 46。FPC14 放置成让导电电镀面 46 与基座 9 对向或者当接。该导电电镀面 46 具有和增强板 41 相同的面积，与 FPC14 上的通常的 GND 模样相比具有更大的面积。此外，与 FPC14 的激光二极管 10 的引线连接用端子以及孔 43 对应的、增强板 41 的背面部分 47 上没有形成导电电镀面 46。

上述 FPC14 的凸出部 14a 在组装过程中如图 4 所示，具有从增强板 41 的外形凸出的状态。在凸出部 14a 的背面一侧粘贴了两面粘接片（图中未画出），从图 4 的状态到图 5 所示，FPC14 的凸出部 14a 向增强板 41 的背面一侧弯折并由两面粘接片粘接，进一步通过焊锡 48 让导电电镀面 45 和增强板 41 的导电电镀面 46 电导通。这样，GND 模样 36a 与具有比较大面积的增强板 41 的导电电镀面 46 用极短的布线就进行了电连接，可以获得稳定的 GND。因此，可以抑制无用的辐射，获得降低噪声的效果（-10db 左右）。特别是，在高频重叠电路 35 不是采用另外的印刷电路板而是搭载在 FPC14 上的状态下，减少了布线引线，用短布线就可以获得稳定的 GND，抑制无用辐射的效果很显著。

另外，FPC14 为 2 层结构，所以可以在第 1 层上形成部件搭载的外围电路模样以及 GND 模样 36a，而在第 2 层的几乎整个面上可以形成铜箔（图中未画出）。在该结构中，第 1 层的外围电路模样和第 2 层的铜箔面通过孔进行电连接，并且，第 1 层的 GND 模样 36a 和第 2 层的铜箔面同样进行电连接。这样，从外围电路模样就不需要向 GND 模样 36a 引布线，可以以最短距离与 GND 连接，可以获得显著的上述作用效果。图 8 为表示图 5(b) 的截面的放大图。

接着，参照图 6 以及图 7 说明 FPC 的另一实施方案。在此所示的实施方案，并不是在上述 FPC14 上设置凸出部 14a，而是采用铜箔片 51 替代。和上述相同，在形成了 GND 模样 36a（图中简略化了模样形状）的 FPC14 上，粘贴有在背面形成了导电电镀面 46 的增强板 41。同时，如图 6 所示，在增强板 41 的导电电镀面 46 上用两面粘接片粘贴铜箔片 51，如图 7 所示，铜箔片 51 的凸部向 FPC14 的 GND 模样 36a 一侧弯曲，在铜箔片 51 和导电电镀面 46 之间，以及铜箔片 51 和 GND 模样 36a 之间用焊锡 48 进行电导通。

在上述构成中，FPC14 的 GND 模样 36a 也可以用极短的布线与面积大而稳定的 GND 连接，和上述相同，可以抑制无用的辐射。

此外，本发明并不限于上述实施方案的构成，而可以进行各种变形。例如，FPC14 的 GND 模样 36a 的形状，和增强板 41 的导电电镀面 46 的形状等，对应于任意的方案均可适用。

如上所述，本发明是在采用高频重叠法的光检取装置中，由于将高频重叠电路搭载在设置了连接头的 FPC 上，与将高频重叠电路设置在另外的印刷电路基板的情况相比，可以减少印刷电路板安装的工序，提高组装的作业性。

进一步来说，在外形凸出形成了与 GND 模样导通的导电电镀面或者铜



箔片的 FPC 上，粘贴有在背面形成了导电电镀面的增强板，通过让两者的导电电镀面进行电连接，可以用极短的布线距离将高频重叠电路的 GND 连接于增强板的导电电镀面上所形成的面积大而稳定的 GND，增大抑制无用辐射的效果。

00.12.14

# 说明书附图

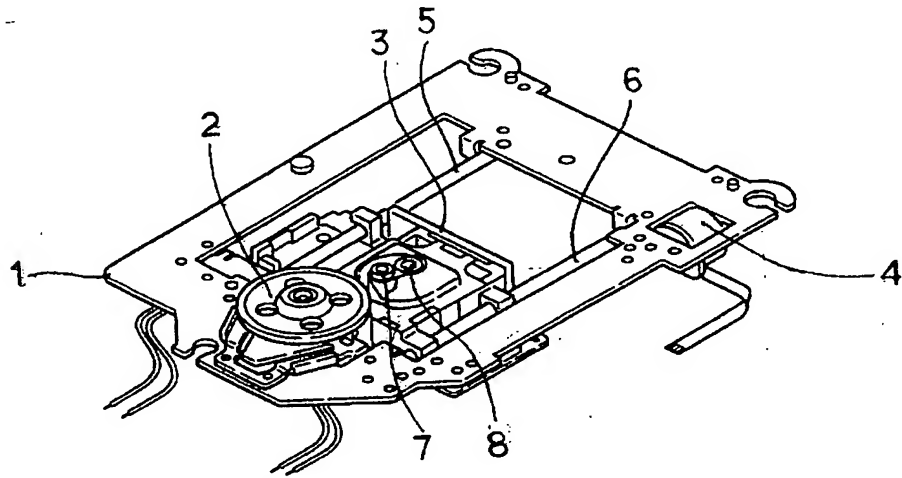


图 1

图 2

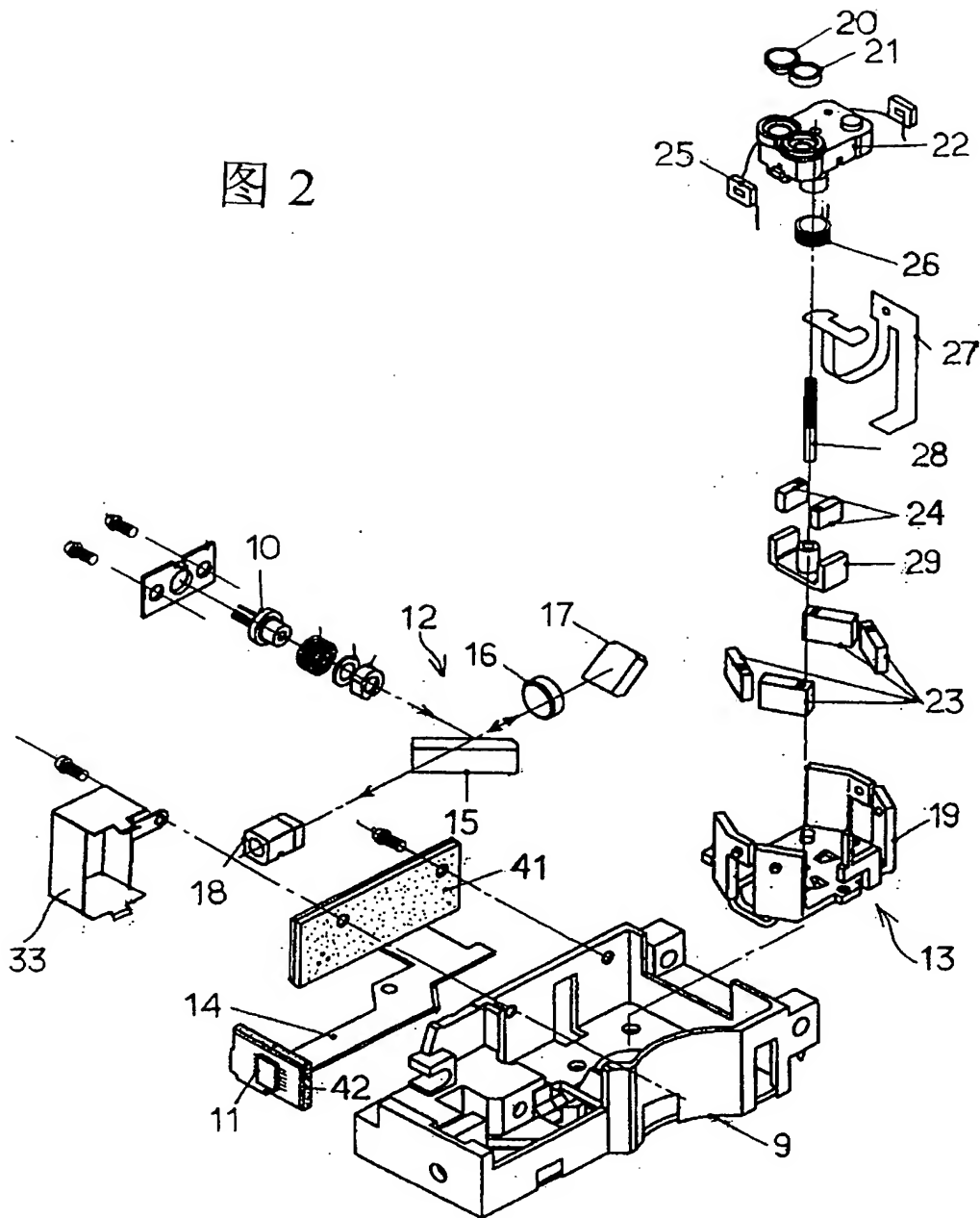


图 3

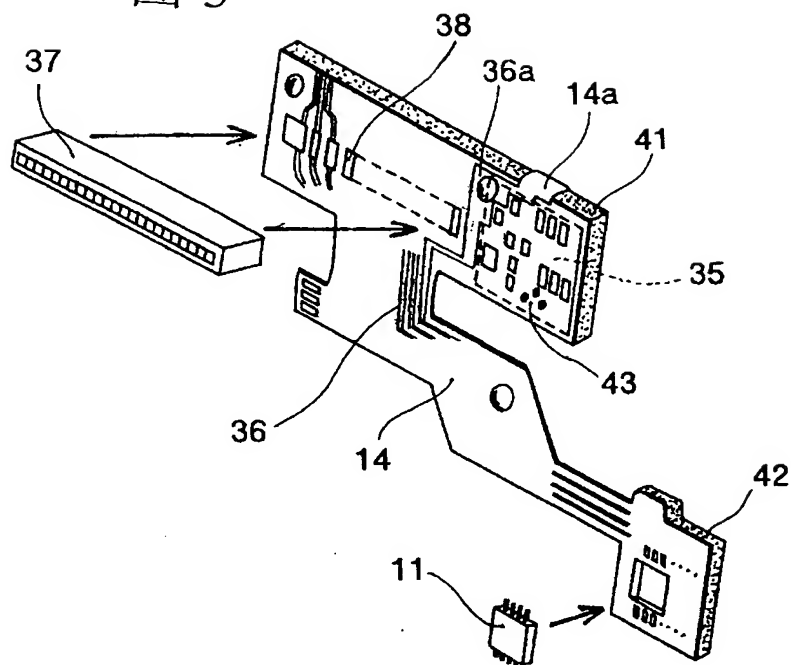


图 4(a)

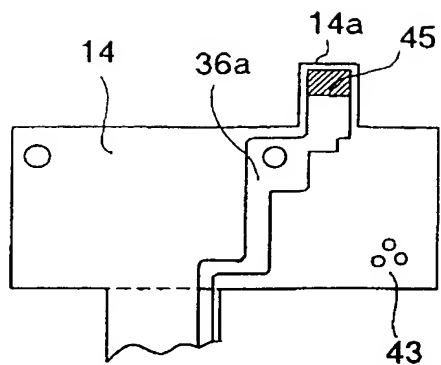


图 4(b)

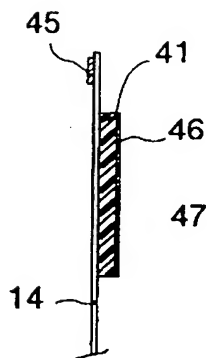


图 4(c)

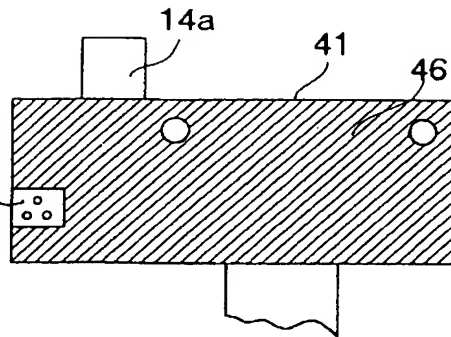


图 5(a)

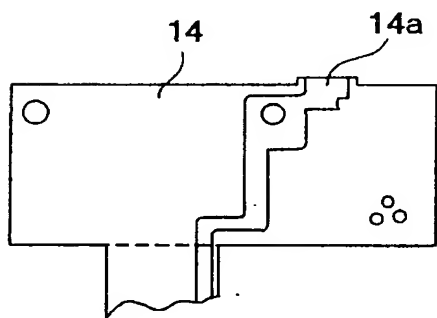


图 5(b)

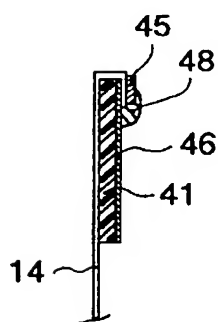


图 5(c)

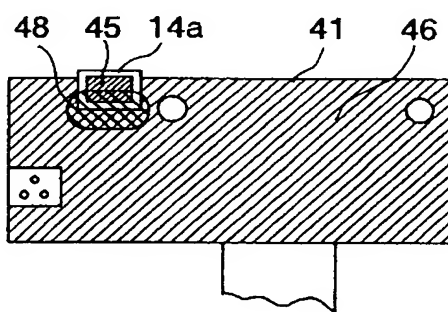


图 6(a)

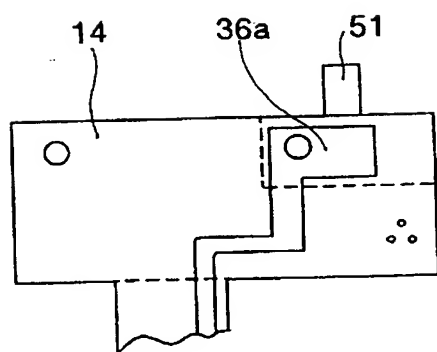


图 6(b)

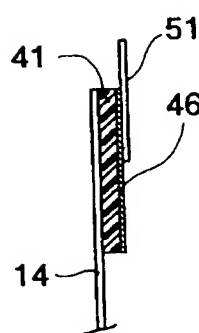


图 6(c)

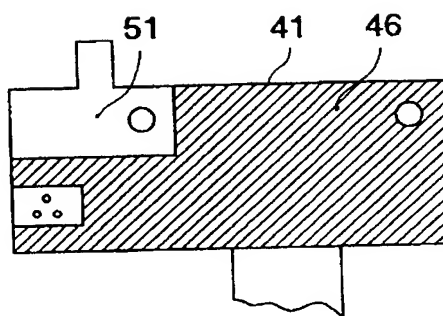


图 7(a)

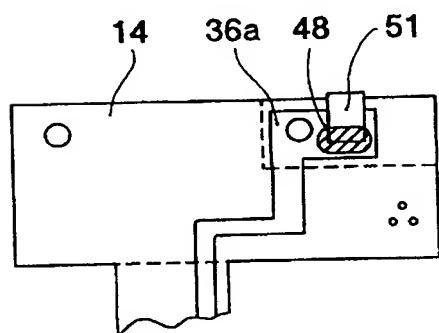


图 7(b)

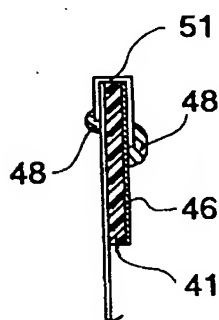
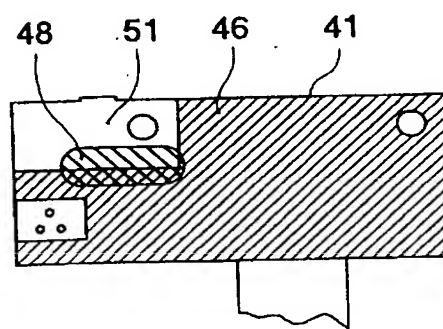


图 7(c)



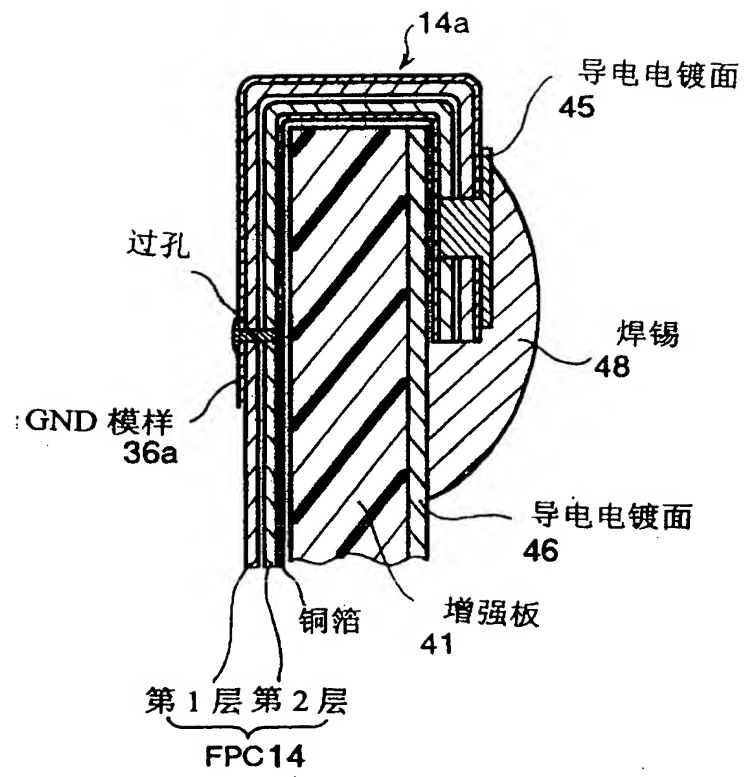


图 8

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